ENTECH
ENGINEERING, INC.
505 ELKTON DRIVE
COLORADO SPRINGS, CO 80907
PHONE (719) 531-5599

PAVEMENT DESIGN REPORT
RETREAT AT PRAIRIE RIDGE, FILING NO. 2
BRIARGATE BOULEVARD AND DINES BOULEVARD
EL PASO COUNTY, COLORADO

PCD File No. SF259 and PAV264

Prepared for:
Classic SRJ
2138 Flying Horse Club Drive
Colorado Springs, CO 80921

Attn: Austin Lenz

May 6, 2026

Respectfully Submitted,

ENTECH ENGINEERING, INC.

Lucas Morrison
Geotechnical Engineering Staff

Reviewed by:

COLORADO LICENSED
JOSEPH C GOODE III
52381
PROFESSIONAL ENGINEER

Digitally signed by Joseph C Goode III
Date: 05/06/26

Joseph C. Goode III, P.E.
Sr. Engineer

ACCEPTED for FILE
By: Bret Dilts, PE
Senior Engineer
Date: 05/12/2026 9:27:06 AM
El Paso County Department of Pubic Works

EL PASO COUNTY EST. 1861

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Entech Job No. 241932

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1 Introduction

Entech Engineering, Inc. (Entech) completed this pavement design report for the Briargate Parkway and Dines Boulevard roadways within the Retreat at Prairie Ridge, Filing No. 2. This report describes the subsurface exploration program and laboratory testing program conducted for the proposed roadway improvements and provides pavement section alternatives and construction recommendations. Entech participated in this project as a subconsultant to Classic SRJ. The contents of this report, including the pavement design recommendations, are subject to the limitations and assumptions presented in Section 7.

2 Project Description

The site is located northeast of the intersection of Vollmer Road and Briargate Parkway within the Retreat at Prairie Ridge, Filing No. 2, in El Paso County, Colorado (Figure 1). The proposed improvements include paving portions of Briargate Parkway and the round-about connections to Dines Boulevard within the Retreat at Prairie Ridge, Filing No. 2. The extent of our investigation is shown in Figure 2.

At the time of our subsurface exploration program, the existing roadway was rough-graded, and utilities had been installed. Surrounding properties comprise vacant land, land being developed for future residential lots, and an existing subdivision. Based on the development plans, Briargate Parkway is designated as an urban principal 4-lane arterial roadway, and Dines Boulevard is designated as an urban residential collector roadway.

3 Subsurface Explorations and Laboratory Testing

3.1 Subsurface Exploration Program

Subsurface conditions within the project site were explored by nine test borings, designated TB-1 through TB-9, drilled on March 4, 2026. The locations of the test borings are shown on the Site and Exploration Plan (Figure 2). The borings were drilled to depths of 5 to 10 feet below the existing ground surface (bgs). The drilling was performed using a truck-mounted, continuous flight auger drill rig supplied and operated by Entech. Descriptive boring logs providing the lithologies of the subsurface conditions encountered during drilling are presented in Appendix A. Groundwater levels were measured in each of the open boreholes at the conclusion of drilling.

Soil samples were obtained from the borings utilizing the Standard Penetration Test (ASTM D1586) using a 2-inch outside diameter split spoon or a 2½-inch modified California sampler. Results of the Standard Penetration Test (SPT) are included on the boring logs in terms of N-values expressed in blows per foot (bpf). Soil samples recovered from the borings were visually classified and recorded on the boring logs. The soil classifications were later verified utilizing laboratory testing and grouped by soil type. The soil type numbers are included on the boring logs. It should be understood that the soil descriptions shown on the boring logs may vary between boring locations and sample depths. It should also be noted that the lines of stratigraphic separation shown on the boring logs represent approximate boundaries between soil types, and the actual stratigraphic transitions may be more gradual or variable with location.

3.2 Geotechnical Index and Engineering Property Testing

Water content testing (ASTM D2216) was performed on the samples recovered from the borings, and the results are shown on the boring logs. Grain-size analysis (ASTM D422) and Atterberg limits testing (ASTM D4318) were performed on selected samples to assist in classifying the materials encountered in the borings.

For pavement design, a Modified Proctor (ASTM D1557) and a California Bearing Ratio (CBR) test (ASTM D1883) were completed. Soluble sulfate testing was performed on select soil samples to evaluate the potential for below-grade degradation of concrete due to sulfate attack. The laboratory testing results are presented in Appendix B and summarized in Table B-1.

Compressive strength testing of cement-treated soil was conducted on a representative soil sample collected from boring TB-3 and is presented in Section 5.2. A summary of the testing results is attached in Appendix B, Table B-2.

4 Subgrade Conditions

Three primary soil types and one bedrock type were encountered in the test borings drilled for the subsurface investigation. Each soil type was classified in accordance with the Unified Soil Classification System (USCS) and the American Association of State Highway and Transportation Officials (AASHTO) soil classification system using the laboratory testing results and the observations made during drilling.

4.1 Subsurface Conditions

Subsurface conditions along the proposed roadways generally consisted of medium dense to dense silty sand fill (Soil Type 1, AASHTO A-1-b, A-2-4, A-2-6). Native hard sandy clay (Soil Type 2, AASHTO A-4) was encountered underlying Soil Type 1 in boring TB-4 at 4 feet bgs and extended to the termination depth of the boring. Native medium dense silty sand (Soil Type 3, AASHTO A-1-b, A-2-6) was encountered underlying Soil Type 1 in borings TB-8 and TB-9 at depths of 4 feet and 2 feet bgs, respectively. Sandstone bedrock, or very dense silty sand when classified as a soil (Soil Type 3, AASHTO A-2-4, A-4), was encountered underlying Soil Type 1 in borings TB-1 and TB-2 at a depth of 1 foot bgs and extended to the termination depth of both borings.

Laboratory test results are presented in Appendix B and are summarized in Table B-1.

4.2 Groundwater

Groundwater was not encountered in the test borings. Groundwater fluctuations are possible and will depend on seasonal variations, local precipitation, runoff, and other factors; however, we do not anticipate that groundwater will affect the proposed roadway construction.

5 Pavement Design Recommendations

Pavement design recommendations were made in accordance with the *El Paso County Engineering Criteria Manual (ECM).*

5.1 Subgrade Conditions

California Bearing Ratio (CBR) testing was performed on a representative sample of the Soil Type 1 silty sand fill from TB-3 to determine the support characteristics of the subgrade soils. The results of the CBR testing are presented in Appendix B and summarized in Exhibit 1.

Exhibit 1: Subsurface Laboratory Testing Summary

Design Parameter	Value
Soil Type	1 – Silty Sand
CBR at 95%	35.3
Design CBR	10
Liquid Limit	NV
Plasticity Index	NP
Percent Passing 200	21.9
AASHTO Classification	A-2-4
Unified Soils Classification	SM

5.2 Cement-Treated Subgrade Design

Strength testing for the site subgrade soils was performed on a set of soil-cement samples from boring TB-3 (Soil Type 1). Testing was performed on soil-cement samples prepared with 2% and 4% Portland Cement Type 1L. A compressive strength of 160 pounds per square inch (psi) is recommended for cement-stabilized subgrade. The results of the strength testing and Modified Proctor (ASTM D1557) maximum dry density are presented in Appendix B and summarized in Exhibit 2. A **2% mix is recommended** for Soil Type 1 based on the laboratory test results.

Exhibit 2: Subsurface Laboratory Testing Summary

Design Parameter	Value
Soil Type	1 – Clayey Sand Fill
Design CBR	10
Average Compressive Strength for 2% Mix (psi)	430 [1]
Average Compressive Strength for 4% Mix (psi)	430 [1]
Optimum Moisture Content (%)	8.1
Maximum Dry Density (pcf)	129.4

Note:

1. A low-capacity break machine was utilized for strength testing; however, the samples exceeded the machine's maximum capacity.

The amount of cement applied shall be a minimum of 2% (by weight) of the subgrade's maximum dry density as determined by the Modified Proctor (ASTM D1557) for granular soils.

5.3 Swell Mitigation

El Paso County requires swell mitigation for soils with swell testing results greater than 2% under a surcharge of 150 pounds per square foot (psf). Based on the swell testing and classification of the subgrade soils, mitigation for expansive soils is not required on this site.

5.4 Traffic Loading

Traffic data is not available for the proposed roadways within the Retreat at Prairie Ridge, Filing No. 2; however, Briargate Parkway is designated as an urban principal 4-lane arterial roadway, and Dines Boulevard is designated as an urban residential collector roadway based on current development plans. The *El Paso County Engineering Criteria Manual* provides default 18-kip equivalent single axle loadings (ESAL) based on the street classification. For design, a default ESAL value of 5,256,000 was used for the urban principal 4-lane arterial roadway designation, and a default ESAL value of 821,000 was used for the urban residential collector roadway designation.

5.5 Pavement Design

The pavement sections were determined utilizing the *El Paso County Engineering Criteria Manual*, the CBR testing, and the default ESAL. Design parameters used in the pavement analysis are presented in Exhibit 3.

Exhibit 3: Pavement Design Parameters

Design Parameter	Value
Reliability	
Principal 4-Lane Arterial	90%
Residential Collector	85%
Standard Deviation	0.45
Serviceability Loss (Δ psi)	2.0
Design CBR	10
Resilient Modulus	15,000 psi
Structural Coefficients	
Hot Bituminous Pavement	0.44
Aggregate Base Course	0.11
Recycled Concrete Base	0.11
Cement-Treated Soil	0.11

Pavement section alternatives recommended for the proposed roadways are summarized in Exhibit 4. The pavement design calculations are presented in Appendix C.

Exhibit 4: Recommended Pavement Sections

Pavement Area	Roadway Designation	Design ESAL	Alternative [1]
Briargate Parkway	Principal Arterial 4-Lane	5,256,000	1. 5.0 inches HMA over 12.0 inches ABC/RCB
			2. 5.0 inches HMA over 12.0 inches CTS [2]
Dines Boulevard	Residential Collector	821,000	1. 4.0 inches HMA over 8.0 inches ABC/RCB
			2. 4.0 inches HMA over 8.0 inches CTS [2]

ABC = Aggregate Base Course; CTS = Cement-Treated Soil; ESAL = Equivalent Single Axle Loads; HMA = Hot Mix Asphalt; RCB = Recycled Concrete Base

Notes:

1. All pavement alternatives meet the minimum sections required per the *El Paso County Engineering Criteria Manual.*
2. The use of CTS will require a deviation request approval.

6 Construction Recommendations

Pavement design recommendations provided herein are contingent on good construction practices, and poor construction techniques may result in poor performance. Our analyses assumed that this project would be constructed according to the *El Paso County Engineering Criteria Manual* and the *Pikes Peak Region Asphalt Paving Specifications*.

6.1 Earthwork Recommendations for Pavement Subgrade

Proper subgrade preparation is required for adequate pavement performance. Paving areas should be cleared of all deleterious materials, including but not limited to existing pavements, utility poles, and fence poles. Surface vegetation, if any, should be removed by stripping, with the depth to be field-determined.

6.1.1 Subgrade Preparation – Unbound Base Alternatives

If pavement section alternatives are selected utilizing aggregate base course (ABC) or recycled concrete base (RCB), the final subgrade surface should be scarified to a depth of 8 inches, moisture conditioned within +/- 2% of the optimum water content, and recompacted to 95% of the Modified Proctor (ASTM D1557) maximum dry density.

The compacted surface below pavements should be proof rolled with a fully loaded, tandem-axle, 10-yard dump truck or equivalent. Any areas that are delineated to be soft, loose, or yielding during proof rolling should be removed and reconditioned, or replaced.

6.1.2 Subgrade Preparation – Cement-Treated Base

If pavement section alternatives are selected utilizing cement-treated soil (CTS), a preliminary proof roll should be completed with a fully loaded, tandem-axle, 10-yard dump truck or equivalent prior to placement of cement stabilization. Any areas that are delineated to be soft, loose, or yielding during proof rolling should be removed and reconditioned, or replaced.

Following the preliminary proof roll, the subgrade shall be stabilized by the addition of cement. The amount of cement applied shall be a minimum of 2% (by weight) of the subgrade's maximum dry density as determined by the Modified Proctor (ASTM D1557) for granular soils or by the Standard Proctor (ASTM D698) for cohesive soils. The cement should be spread evenly on the subgrade surface and thoroughly mixed into the subgrade such that a uniform blend of soil and cement is achieved to the CTS design depth. Densification of the cement-stabilized subgrade should be completed to obtain a compaction of at least 95% of the subgrade's maximum dry density as determined by the Modified Proctor (ASTM D1557) or by the Standard Proctor (ASTM D698). Satisfactory compaction of the subgrade shall occur within 90 minutes from the time of mixing the cement into the subgrade.

The following conditions shall be followed as part of the subgrade stabilization:

- Type 1L cement as supplied; a local supplier shall be used. All cement used for stabilization should come from the same source. If cement sources are changed, a new laboratory mix design should be completed.
- Moisture conditioning of the subgrade and/or mixing of the cement into the subgrade shall not occur when soil temperatures are below 40 degrees F. Cement-treated subgrades should be maintained at a temperature of 40 degrees F or greater until the subgrade has been compacted as required.
- Cement placement, cement mixing, and compaction of the cement-treated subgrade should be observed by Entech Engineering. Testing should include in-situ compaction tests and representative compacted specimens of the treated subgrade material for subsequent laboratory quality assurance testing. Testing reports will be provided to El Paso County as construction progresses.
- A minimum 7-day CTS compressive strength of 125 psi must be achieved.
- Soil strengths in excess of 275 psi will require microfracturing. Microfracturing will be completed using the Standard Method as defined by the *City of Colorado Springs Draft Standard Specification,* Section 305 – Chemically-Treated Subgrade. Microfracturing will be

performed with the same (or equivalent tonnage) steel drum vibratory roller used for compaction of the CTS. A minimum 12-ton roller shall be used. Three full passes with the roller operating at maximum amplitude and traveling at 2- 3 mph shall be applied. If the treated material breaks up excessively at the surface, the vibration amplitude shall be decreased or eliminated.

6.1.3 Fill Placement and Compaction

Granular fill placed as part of the pavement subgrade shall consist of nonexpansive, granular soil, free of organic matter, unsuitable materials, debris, and cobbles greater than 3 inches in diameter. Additionally, any granular fill placed as part of the roadway subgrade should have a minimum CBR of 10. All granular fill placed within the pavement subgrade should be compacted to a minimum of 95% of the Modified Proctor (ASTM D1557) maximum dry density at +/-2% of optimum moisture content. Fill material should be placed in horizontal lifts such that each finished lift has a compacted thickness of 6 inches or less. Entech should approve any imported fill to be used within the pavement subgrade area prior to delivery to the site.

6.1.4 Aggregate Base Course and Recycled Concrete Base

ABC or RCB materials shall conform to the *El Paso County Standard Specifications Manual*, Appendix D, Table D-6. ABC or RCB materials should be compacted to a minimum of 95% of the Modified Proctor (ASTM D1557) maximum dry density within +/-2% of optimum moisture content.

6.2 Concrete Degradation Due to Sulfate Attack

Sulfate solubility testing was conducted on several samples recovered from the test borings to evaluate the potential for sulfate attack on concrete. The test results indicated less than 0.01% soluble sulfate (by weight). The test results indicate the sulfate component of the in-place soils presents a negligible to severe exposure threat to concrete placed below the site grade.

As presented in the *Evaluation of Selected Pavement Specifications and Responses to Questions Relevant to Design and Construction of Cement-Treated Soil and Aggregate Layers in El Paso County, Colorado* report from Spencer Gutherie and Robert Stevens dated March 13, 2024, soils with less than 3,000 ppm (0.3%) do not require special construction practices.

6.3 Construction Observation

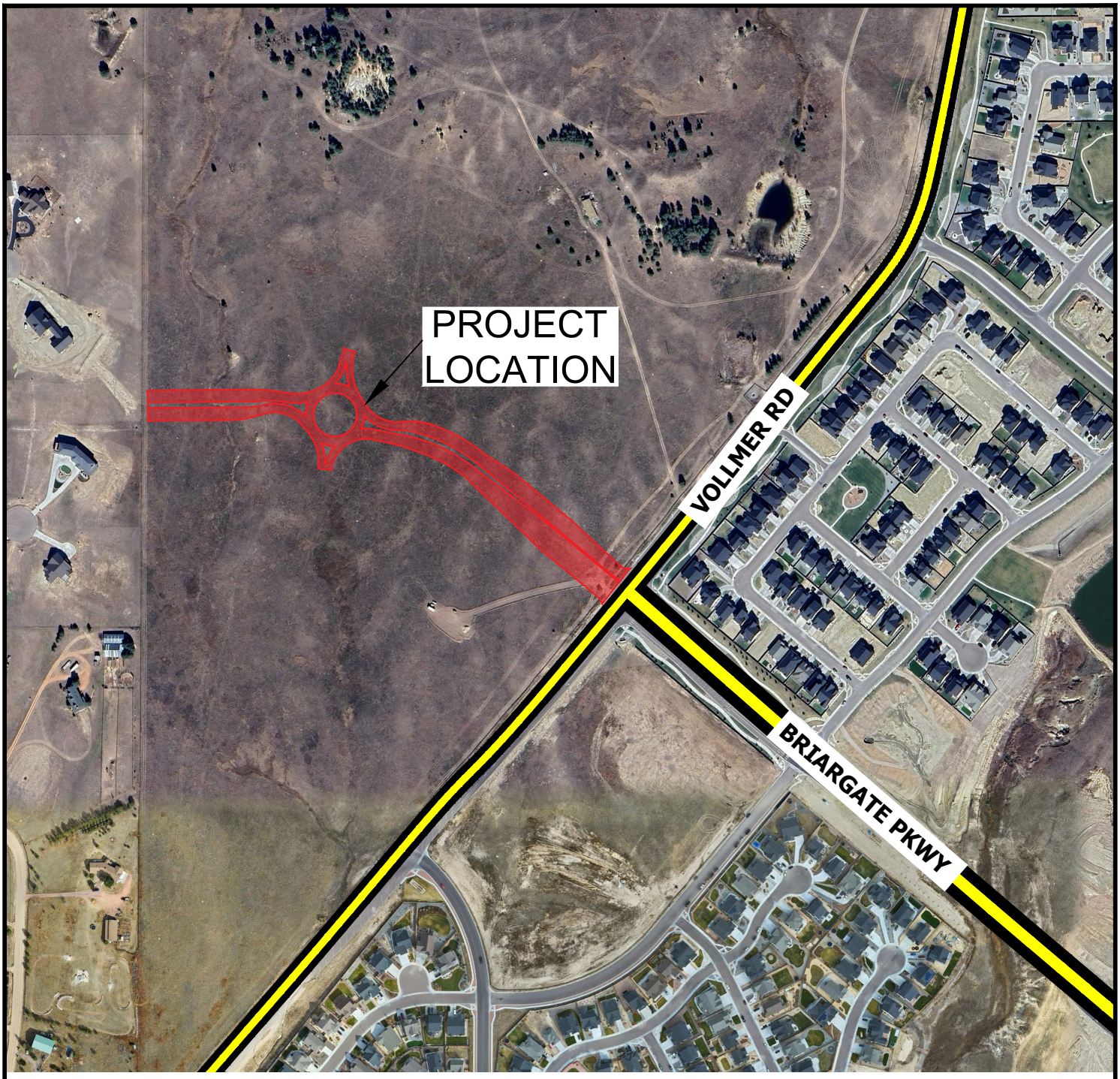
Subgrade preparation for pavement structures should be observed by Entech in order to verify that (1) no anomalies are present, (2) materials similar to those described in this report have been encountered or placed, and (3) no soft spots, expansive or organic soil, or debris are present in

the pavement subgrade prior to paving. Construction observation requirements, as presented in the Use of CTS for Paving Season Memorandum, should be followed.

7 Closure

The subsurface investigation, geotechnical evaluation, and recommendations presented in this report are intended for use by Classic SRJ with application to the paving of Briargate Parkway and Dines Boulevard within the Retreat at Prairie Ridge, Filing No. 2, in El Paso County, Colorado. In conducting the subsurface investigation, laboratory testing, engineering evaluation, and reporting, Entech Engineering, Inc. endeavored to work in accordance with generally accepted professional geotechnical and geologic practices and principles consistent with the level of care and skill ordinarily exercised by members of the geotechnical profession currently practicing in the same locality and under similar conditions. No other warranty, expressed or implied, is made. During final design and/or construction, if conditions are encountered that appear different from those described in this report, Entech Engineering, Inc. requests to be notified so that the evaluation and recommendations presented herein can be reviewed and modified as appropriate.

If there are any questions regarding the information provided herein, or if Entech Engineering, Inc. can be of further assistance, please do not hesitate to contact us.



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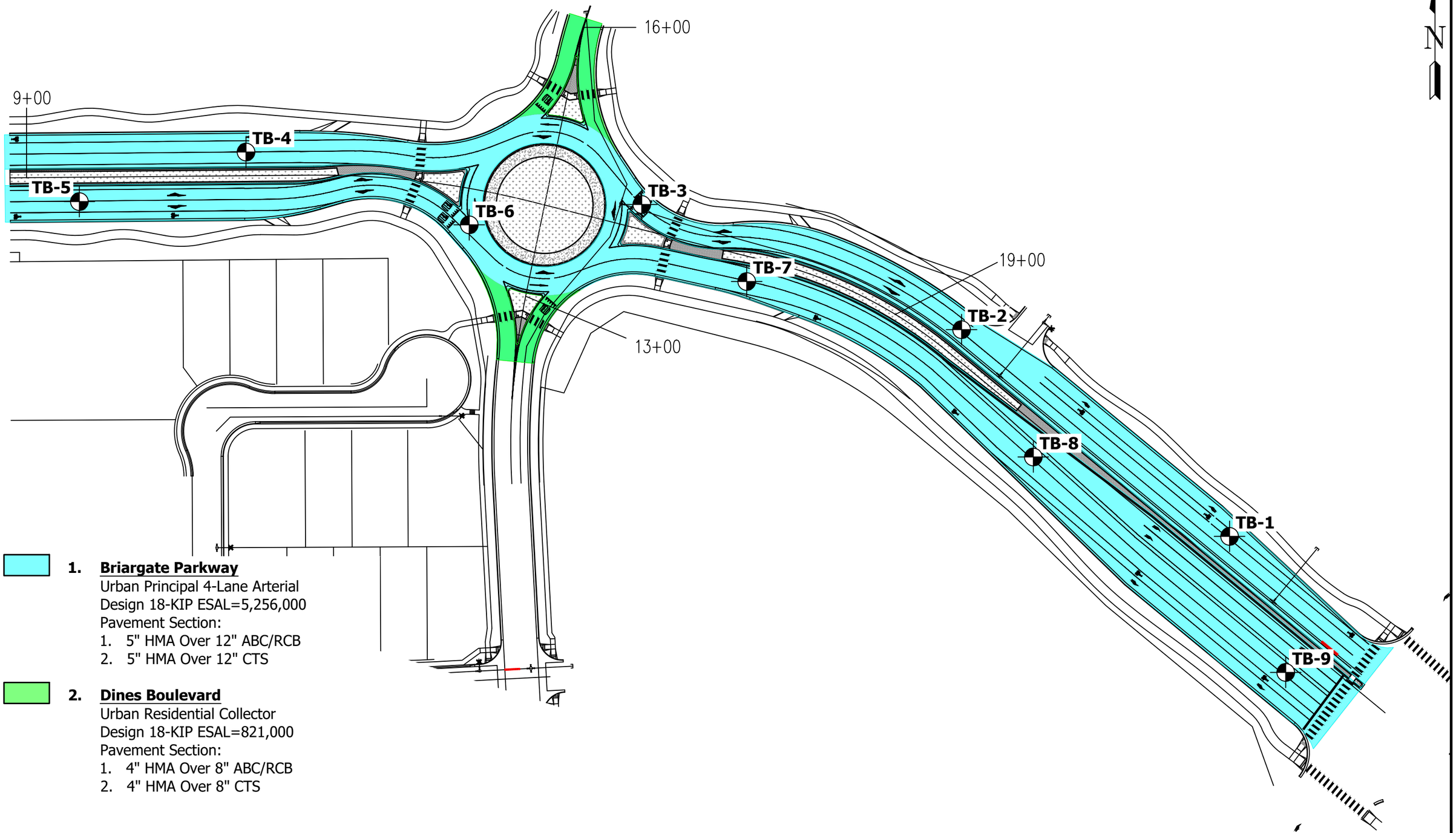
VICINITY MAP

RETREAT AT PRAIRIE RIDGE, FILING NO. 2
CLASSIC SRJ

JOB NO.
241932

FIG. 1



1. **Briargate Parkway**
   Urban Principal 4-Lane Arterial
   Design 18-KIP ESAL=5,256,000
   Pavement Section:
   1. 5" HMA Over 12" ABC/RCB
   2. 5" HMA Over 12" CTS

2. **Dines Boulevard**
   Urban Residential Collector
   Design 18-KIP ESAL=821,000
   Pavement Section:
   1. 4" HMA Over 8" ABC/RCB
   2. 4" HMA Over 8" CTS

TB- APPROXIMATE TEST BORING LOCATION AND NUMBER

SCALE: 0 40 80

ENTECH ENGINEERING, INC.

SITE AND EXPLORATION PLAN

RETREAT AT PRAIRIE RIDGE, FILING NO. 2
CLASSIC SRJ

JOB NO. 241932

FIG. 2

APPENDIX A: Test Boring Logs

TEST BORING 1
DATE DRILLED 3/4/2026

REMARKS

DRY TO 5', 3/4/26

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
					1
			50/5"	10.7	2
5			50/7"	13.7	2
10					
15					
20					

FILL, SAND, SILTY, BROWN

SANDSTONE, VERY WEAK, GRAY to TAN, HIGHLY WEATHERED (SAND, SILTY, VERY DENSE, MOIST)

TEST BORING 2
DATE DRILLED 3/4/2026

REMARKS

DRY TO 10', 3/4/26

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type
					1
			50	4.1	2
5			50/10"	3.6	2
10			50/8"	11.9	2
15					
20					

FILL, SAND, SILTY, BROWN

SANDSTONE, VERY WEAK, GRAY to TAN, HIGHLY WEATHERED (SAND, SILTY, VERY DENSE, MOIST)

ENTECH ENGINEERING, INC.

TEST BORING LOGS

RETREAT AT PRAIRIE RIDGE, FILING NO. 2
CLASSIC SRJ

JOB NO. 241932

FIG. A-1

TEST BORING 3
DATE DRILLED 3/4/2026

REMARKS

DRY TO 5', 3/4/26

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
						FILL 0-5', SAND, SILTY, TAN to BROWN, MEDIUM DENSE, MOIST
			16	7.8	1	
5			19	9.5	1	
10						
15						
20						

TEST BORING 4
DATE DRILLED 3/4/2026

REMARKS

DRY TO 5', 3/4/26

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
						FILL 0-5', SAND, SILTY, TAN to GRAY, MEDIUM DENSE, MOIST
			25	10.6	1	
5			30	13.4	2	FILL, CLAY, SANDY, GRAY, HARD, MOIST
10						
15						
20						

ENTECH ENGINEERING, INC.

TEST BORING LOGS

RETREAT AT PRAIRIE RIDGE, FILING NO. 2
CLASSIC SRJ

JOB NO. 241932

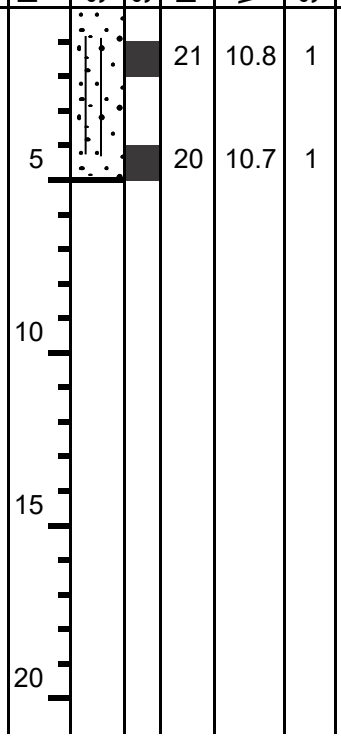
FIG. A-2

TEST BORING 5
DATE DRILLED 3/4/2026

REMARKS

DRY TO 5', 3/4/26

FILL 0-5', SAND, SILTY, TAN to BROWN, MEDIUM DENSE, MOIST



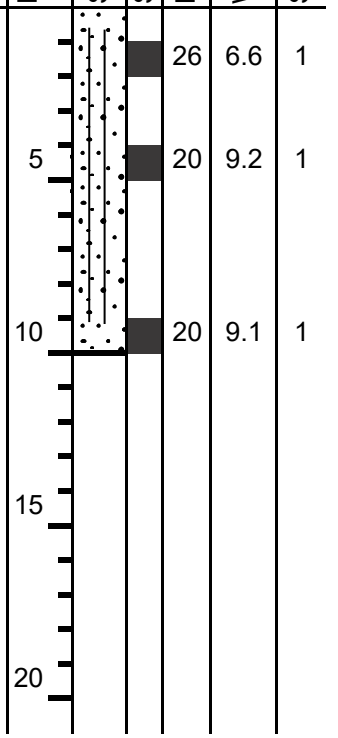
Blows per foot	Watercontent %	Soil Type
21	10.8	1
20	10.7	1

TEST BORING 6
DATE DRILLED 3/4/2026

REMARKS

DRY TO 5', 3/4/26

FILL 0-10', SAND, SILTY, BROWN to TAN, MEDIUM DENSE, MOIST



Blows per foot	Watercontent %	Soil Type
26	6.6	1
20	9.2	1
20	9.1	1

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TEST BORING LOGS

RETREAT AT PRAIRIE RIDGE, FILING NO. 2
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FIG. A-3

TEST BORING 7
DATE DRILLED 3/4/2026

REMARKS

DRY TO 5', 3/4/26

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			17	9.3	1	FILL 0-5', SAND, SILTY, BROWN, MEDIUM DENSE, MOIST
5			23	9.9	1	
10						
15						
20						

TEST BORING 8
DATE DRILLED 3/4/2026

REMARKS

DRY TO 5', 3/4/26

Depth (ft)	Symbol	Samples	Blows per foot	Watercontent %	Soil Type	
			29	5.9	1	FILL 0-4', SAND, SILTY, BROWN, MEDIUM DENSE, MOIST
5			16	7.2	3	SAND, SILTY, BROWN, MEDIUM DENSE, MOIST
10						
15						
20						

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TEST BORING LOGS

RETREAT AT PRAIRIE RIDGE, FILING NO. 2
CLASSIC SRJ

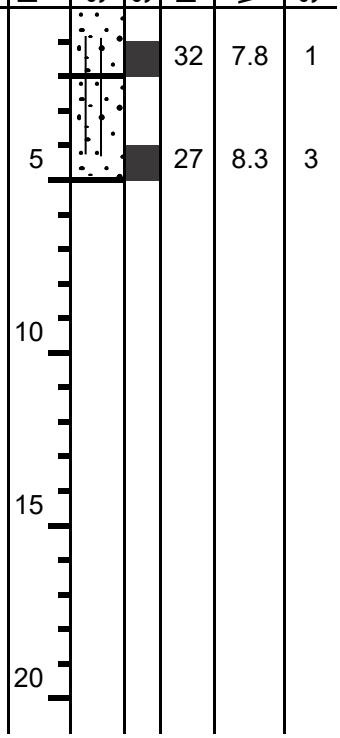
JOB NO. 241932

FIG. A-4

TEST BORING 9
DATE DRILLED 3/4/2026

REMARKS

DRY TO 5', 3/4/26



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TEST BORING LOGS

RETREAT AT PRAIRIE RIDGE, FILING NO. 2
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FIG. A-5

APPENDIX B: Laboratory Test Results

TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

SOIL TYPE	TEST BORING NO.	DEPTH (FT)	WATER (%)	DRY DENSITY (PCF)	PASSING NO. 200 SIEVE (%)	LIQUID LIMIT	PLASTIC LIMIT	PLASTIC INDEX	SULFATE (WT %)	SWELL/ COLLAPSE (%)	AASHTO CLASS. (GROUP INDEX)	USCS	SOIL DESCRIPTION
1, CBR	3	0-3	9.8		21.9	NV	NP	NP			A-2-4 (0)	SM	FILL, SAND, SILTY
1	3	1-2	7.8		13.3	NV	NP	NP	0.00		A-1-b (0)	SM	FILL, SAND, SILTY
1	4	1-2	10.5		23.7	33	25	8			A-1-b (0)	SM	FILL, SAND, SILTY
1	5	1-2	10.5		15.7	36	25	11			A-2-6 (0)	SM	FILL, SAND, SILTY
1	6	1-2	6.6		28.6	NV	NP	NP			A-2-4 (0)	SM	FILL, SAND, SILTY
1	7	1-2	8.7		22.9	NV	NP	NP			A-1-b (0)	SM	FILL, SAND, SILTY
1	8	1-2	5.9		19.8	NV	NP	NP			A-1-b (0)	SM	FILL, SAND, SILTY
1	9	1-2	8.0		21.1	NV	NP	NP			A-1-b (0)	SM	FILL, SAND, SILTY
1	7	0-3	7.4		20.9							SM	FILL, SAND, SILTY
2	4	5	12.0	117.2	65.9	33	23	10	0.00	0.3	A-4 (5)	CL	FILL, CLAY, SANDY
3	8	5	6.9		23.0	NV	NP	NP	<0.01		A-1-b (0)	SM	SAND, SILTY
3	9	5	8.1		11.0	40	27	13			A-2-6 (0)	SM	SAND, SILTY
4	1	1-3	9.7		41.9	NV	NP	NP			A-4 (0)	SM	SANDSTONE (SAND, SILTY)
4	1	1-2	22.2		47.2	NV	NP	NP	<0.01		A-4 (0)	SM	SANDSTONE (SAND, SILTY)
4	2	1-2	4.4		19.2	NV	NP	NP			A-2-4 (0)	SM	SANDSTONE (SAND, SILTY)

Project: Retreat at Prairie Ridge, Filing No. 2
Client: Classic SRJ
Job No: 241932

ENTECH ENGINEERING, INC.

TABLE B-2
SUMMARY OF CTS TEST RESULTS

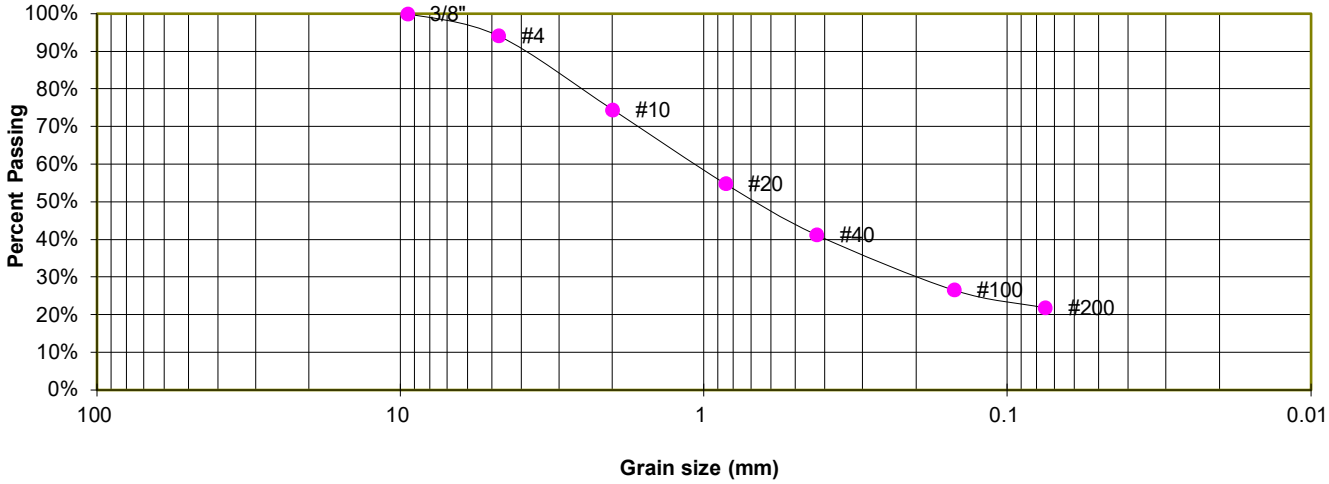
FIELD SAMPLE ID	*SOIL ADDITIVE*	*ADDITIVE PERCENTAGE (%)*	*WATER CONTENT (%)*	*DENSITY (dry)*	*AGE (days)*	*STRENGTH (psi)*
TB-3 @ 0-3'	TYPE IL CEMENT	2	8.1	122.4	7	430*
				122.2		430*
				122.3		430*
					AVERAGE:	**430***
TB-3 @ 0-3'	TYPE IL CEMENT	4	8.1	122.4	7	430*
				122.7		430*
				122.3		430*
					AVERAGE:	**430***

Notes:

1. CURING METHOD: Ambient Temperature Oven

* - Low-capacity break machine was utilized for strength testing; however, the samples exceeded the machine's maximum capacity.

TEST BORING	3	SOIL DESCRIPTION	FILL, SAND, SILTY
DEPTH (FT)	0-3	SOIL TYPE	1, CBR



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	94.2%
10	74.5%
20	54.9%
40	41.3%
100	26.6%
200	21.9%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-2-4
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

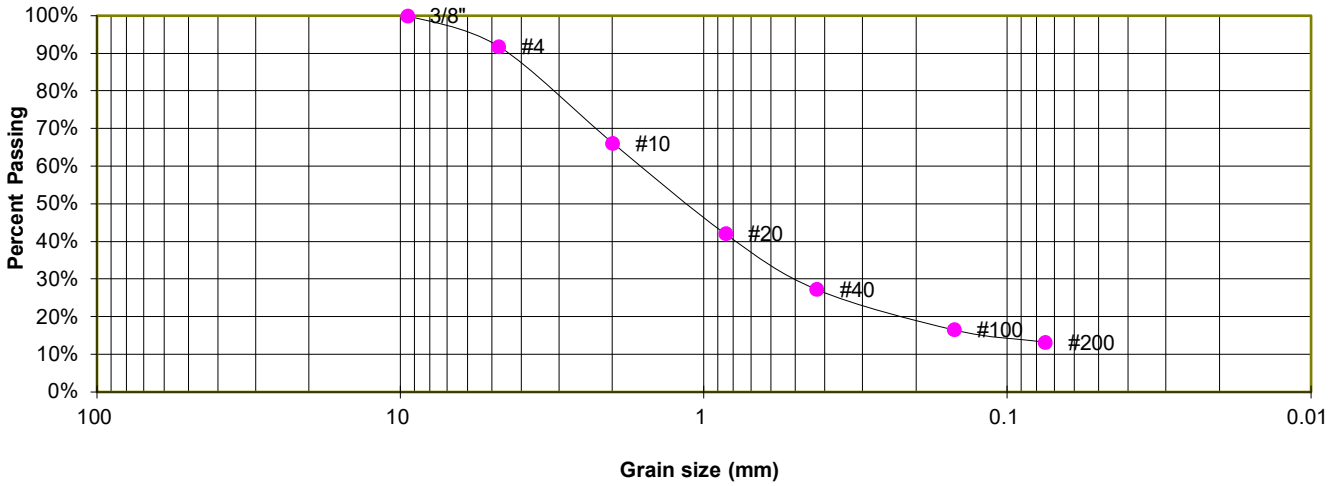
LABORATORY TEST RESULTS

RETREAT AT PRAIRIE RIDGE, FILING NO. 2
CLASSIC SRJ

JOB NO. 241932

FIG. B-1

TEST BORING	3	SOIL DESCRIPTION	FILL, SAND, SILTY
DEPTH (FT)	1-2	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	91.8%
10	66.2%
20	42.1%
40	27.3%
100	16.6%
200	13.3%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-1-b
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

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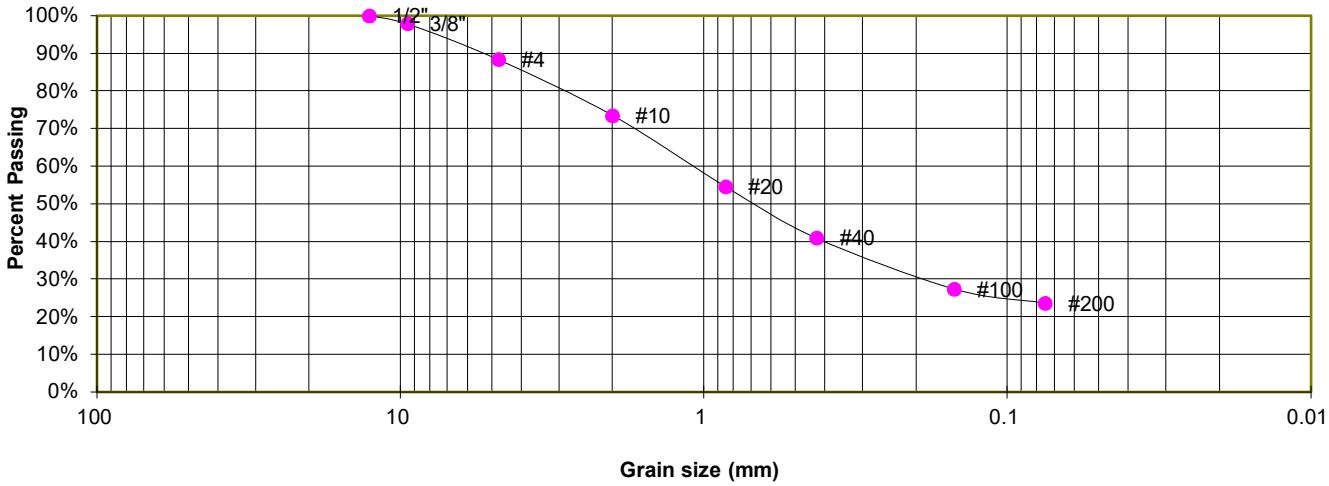
FIG. B-2

TEST BORING	4	SOIL DESCRIPTION	FILL, SAND, SILTY
DEPTH (FT)	1-2	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.9%
4	88.4%
10	73.5%
20	54.6%
40	40.9%
100	27.4%
200	23.7%

ATTERBERG LIMITS

Plastic Limit	25
Liquid Limit	33
Plastic Index	8

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-1-b
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

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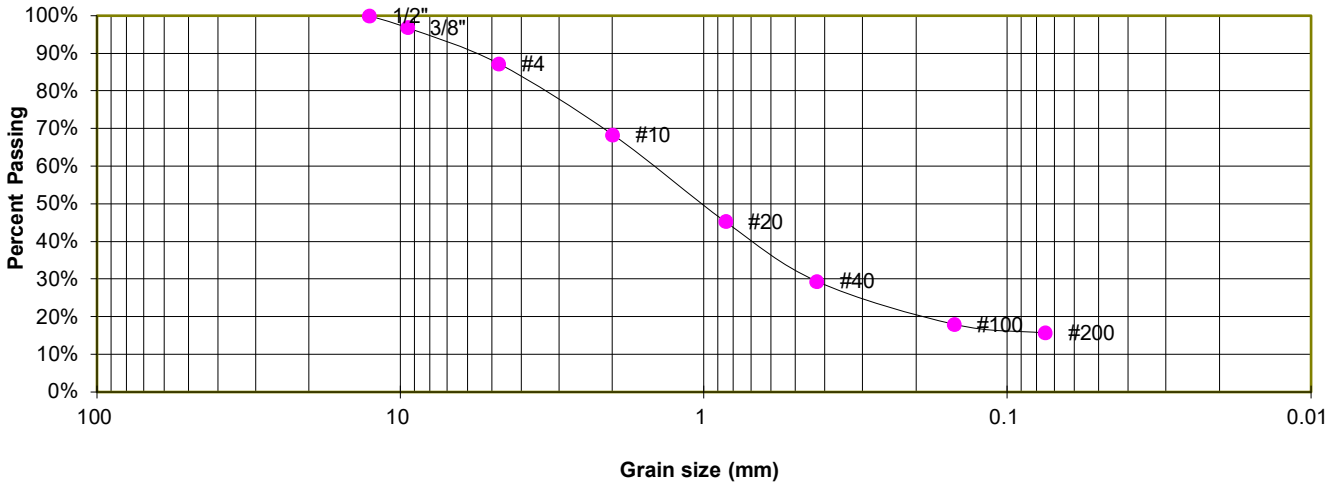
FIG. B-3

TEST BORING	5	SOIL DESCRIPTION	FILL, SAND, SILTY
DEPTH (FT)	1-2	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	96.9%
4	87.3%
10	68.4%
20	45.3%
40	29.5%
100	18.0%
200	15.7%

ATTERBERG LIMITS

Plastic Limit	25
Liquid Limit	36
Plastic Index	11

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-2-6
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

RETREAT AT PRAIRIE RIDGE, FILING NO. 2
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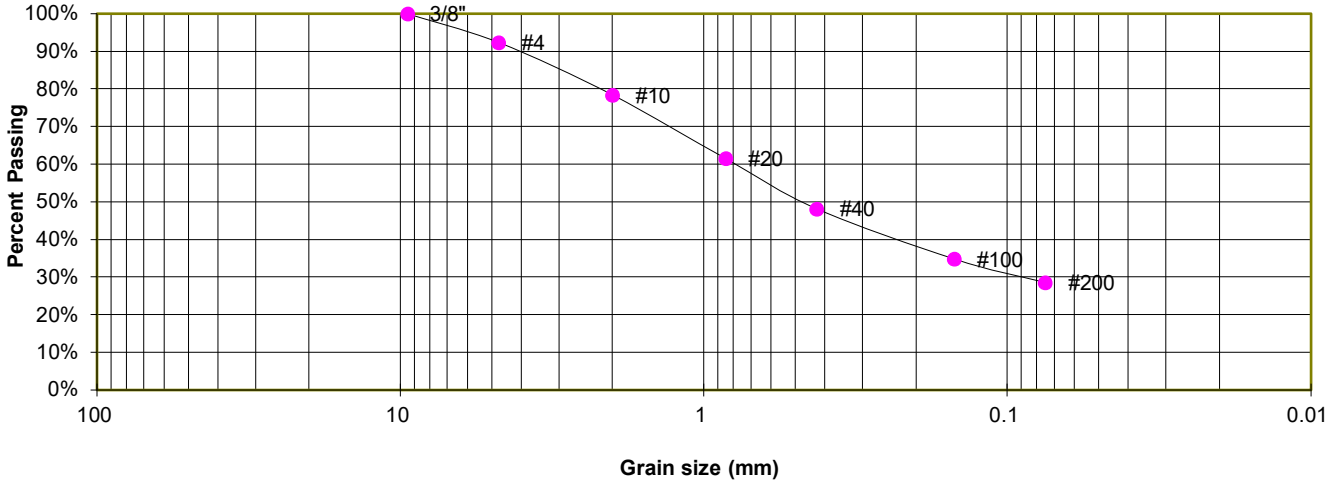
FIG. B-4

TEST BORING	6	SOIL DESCRIPTION	FILL, SAND, SILTY
DEPTH (FT)	1-2	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	92.4%
10	78.4%
20	61.5%
40	48.2%
100	34.8%
200	28.6%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-2-4
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

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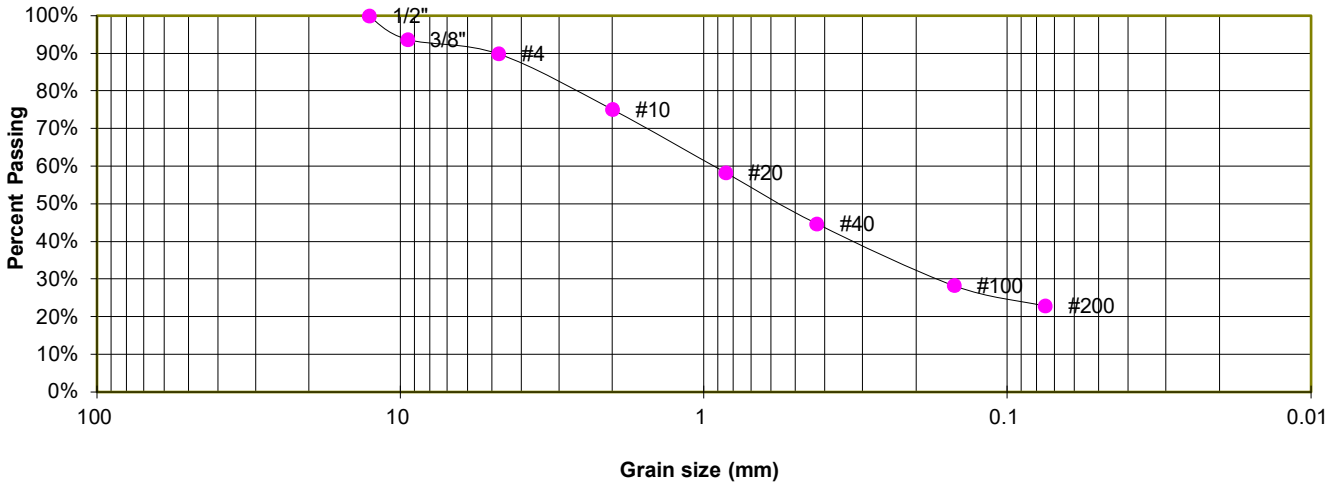
FIG. B-5

TEST BORING	7	SOIL DESCRIPTION	FILL, SAND, SILTY
DEPTH (FT)	1-2	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	93.7%
4	89.9%
10	75.1%
20	58.3%
40	44.7%
100	28.3%
200	22.9%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-1-b
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

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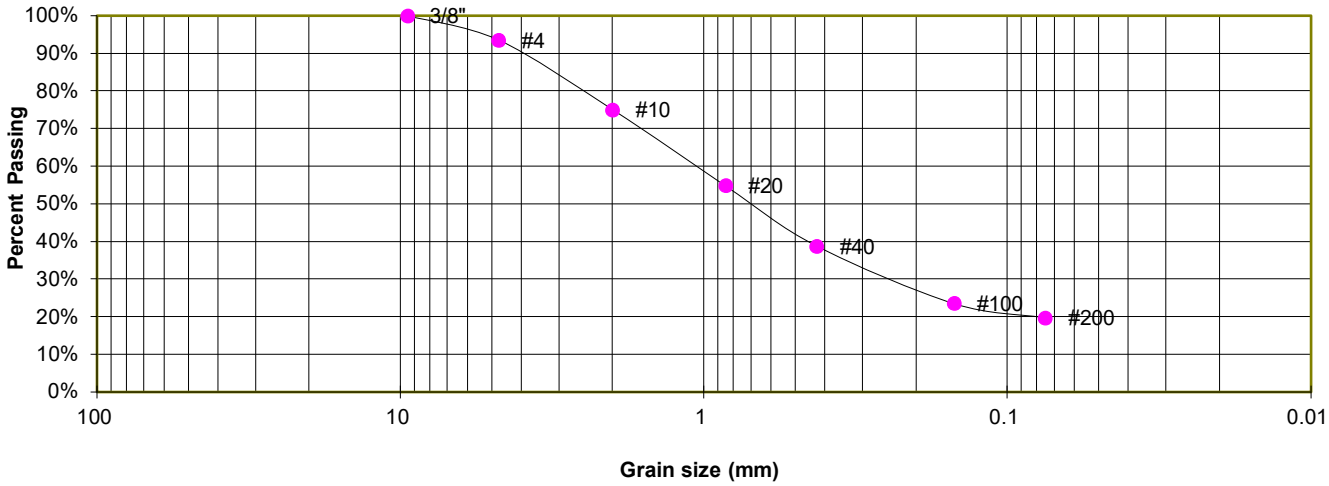
FIG. B-6

TEST BORING	8	SOIL DESCRIPTION	FILL, SAND, SILTY
DEPTH (FT)	1-2	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	93.5%
10	75.0%
20	54.9%
40	38.7%
100	23.6%
200	19.8%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-11-b
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

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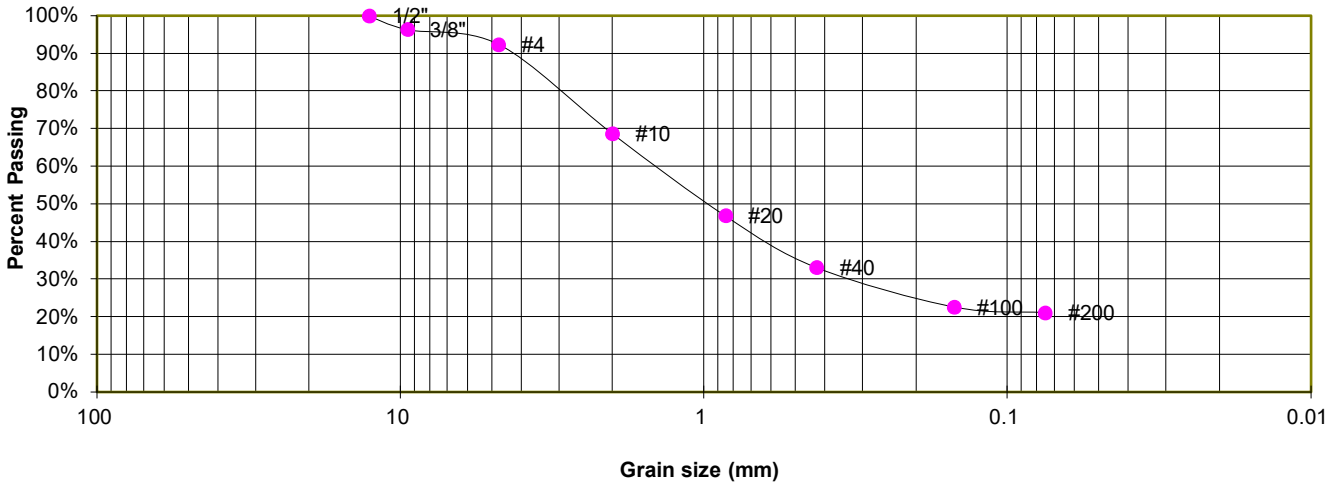
FIG. B-7

TEST BORING	9	SOIL DESCRIPTION	FILL, SAND, SILTY
DEPTH (FT)	1-2	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	96.3%
4	92.4%
10	68.6%
20	46.8%
40	33.1%
100	22.6%
200	21.1%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-1-b
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

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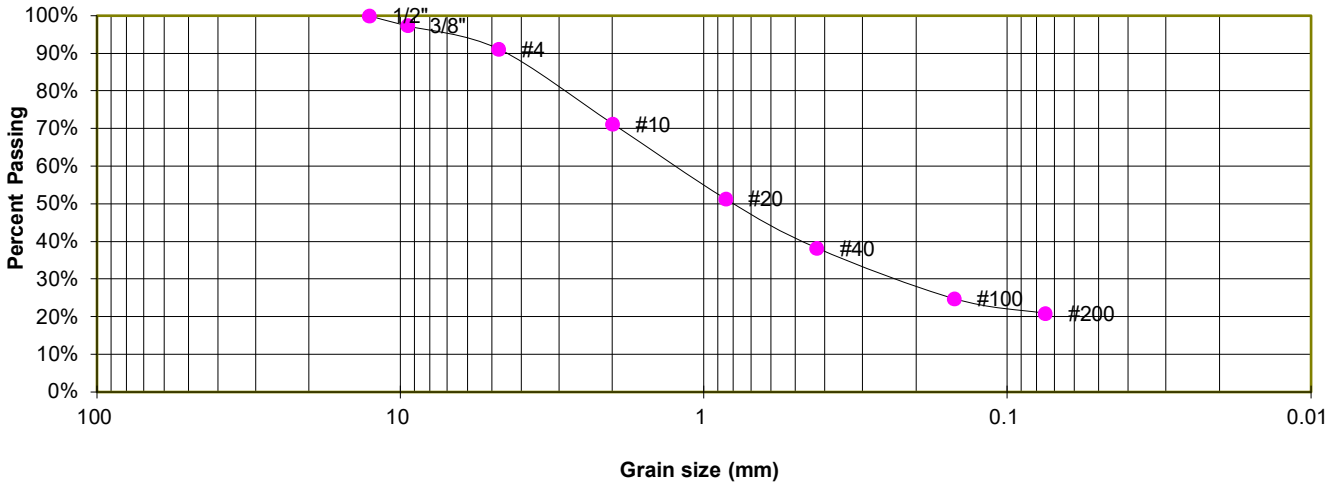
FIG. B-8

TEST BORING	7	SOIL DESCRIPTION	FILL, SAND, SILTY
DEPTH (FT)	0-3	SOIL TYPE	1



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	100.0%
3/8"	97.4%
4	91.2%
10	71.3%
20	51.3%
40	38.2%
100	24.9%
200	20.9%

SOIL CLASSIFICATION

USCS CLASSIFICATION: SM
AASHTO CLASSIFICATION:
AASHTO GROUP INDEX:

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

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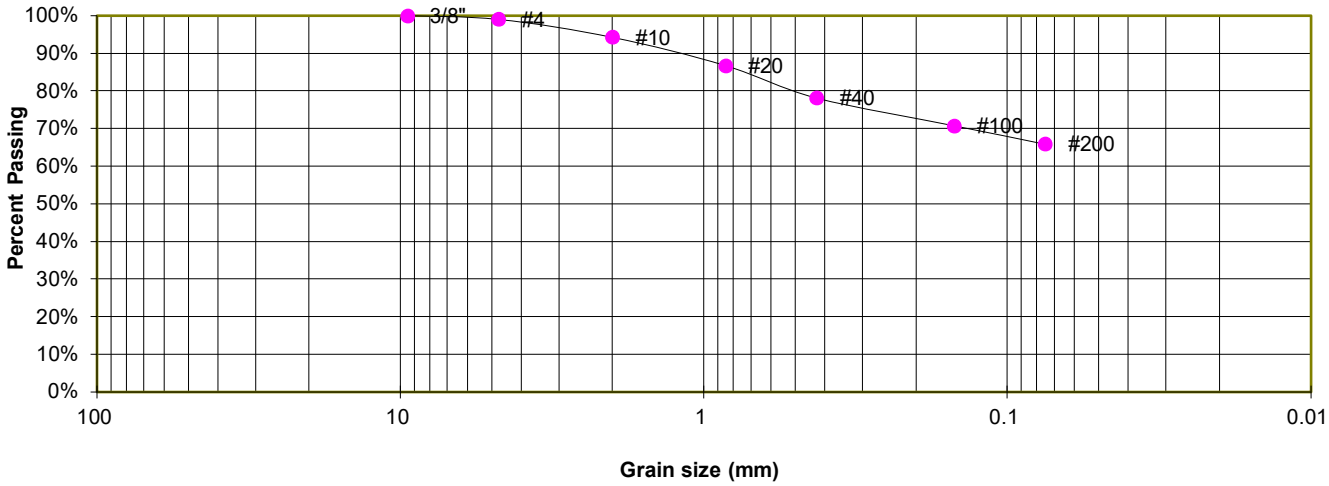
FIG. B-9

TEST BORING	4	SOIL DESCRIPTION	FILL, CLAY, SANDY
DEPTH (FT)	5	SOIL TYPE	2



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.1%
10	94.3%
20	86.8%
40	78.2%
100	70.8%
200	65.9%

ATTERBERG LIMITS

Plastic Limit	23
Liquid Limit	33
Plastic Index	10

SOIL CLASSIFICATION

USCS CLASSIFICATION:	CL
AASHTO CLASSIFICATION:	A-4
AASHTO GROUP INDEX:	5

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

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CLASSIC SRJ

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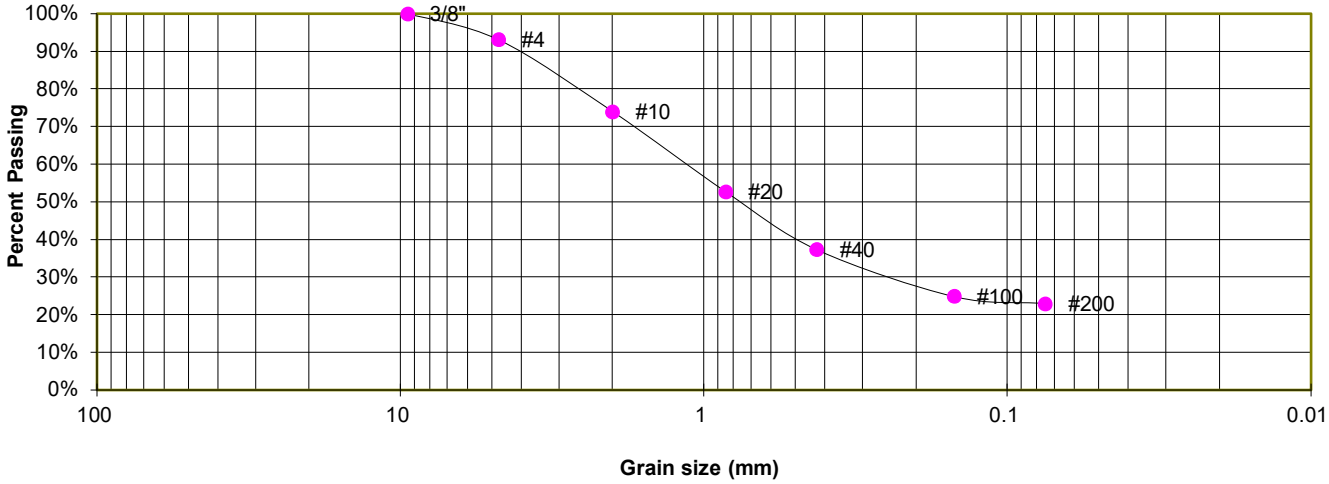
FIG. B-10

TEST BORING	8	SOIL DESCRIPTION	SAND, SILTY
DEPTH (FT)	5	SOIL TYPE	3



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	93.1%
10	74.0%
20	52.8%
40	37.3%
100	24.9%
200	23.0%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-1-b
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

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CLASSIC SRJ

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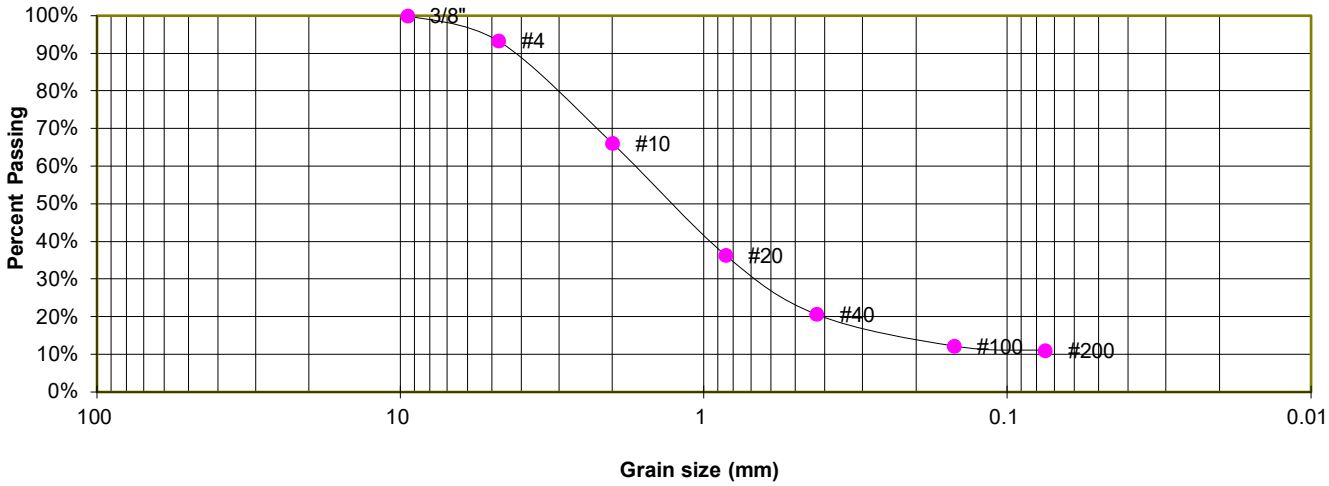
FIG. B-11

TEST BORING	9	SOIL DESCRIPTION	SAND, WITH SILT
DEPTH (FT)	5	SOIL TYPE	3



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	93.3%
10	66.1%
20	36.4%
40	20.6%
100	12.2%
200	11.0%

ATTERBERG LIMITS

Plastic Limit	27
Liquid Limit	40
Plastic Index	13

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-2-6
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

RETREAT AT PRAIRIE RIDGE, FILING NO. 2
CLASSIC SRJ

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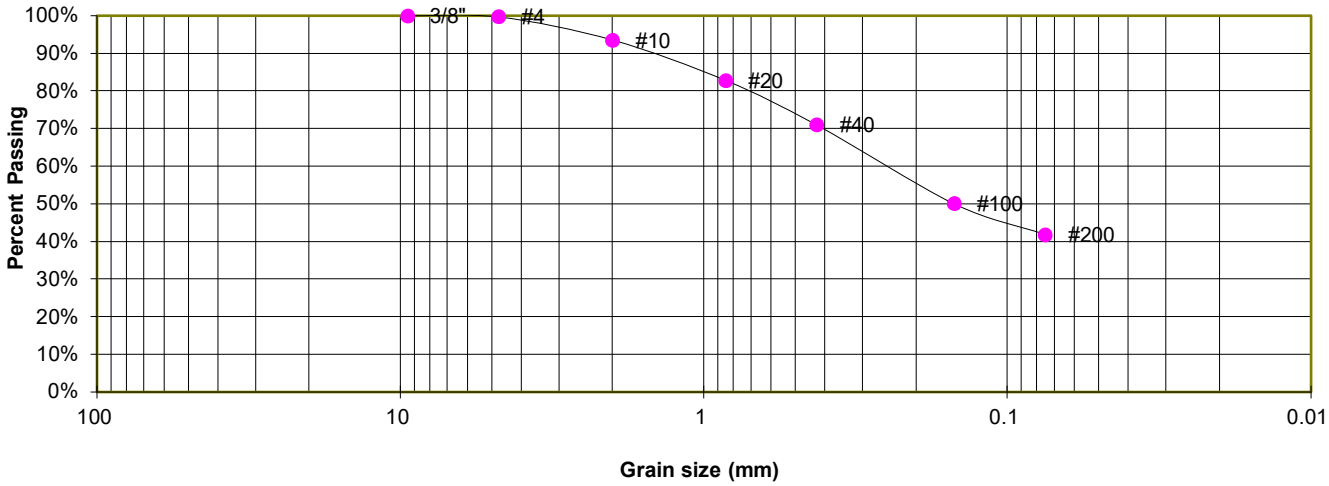
FIG. B-12

TEST BORING	1	SOIL DESCRIPTION	SANDSTONE (SAND, SILTY)
DEPTH (FT)	1-3	SOIL TYPE	4



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	99.7%
10	93.6%
20	82.8%
40	71.0%
100	50.1%
200	41.9%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-4
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

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CLASSIC SRJ

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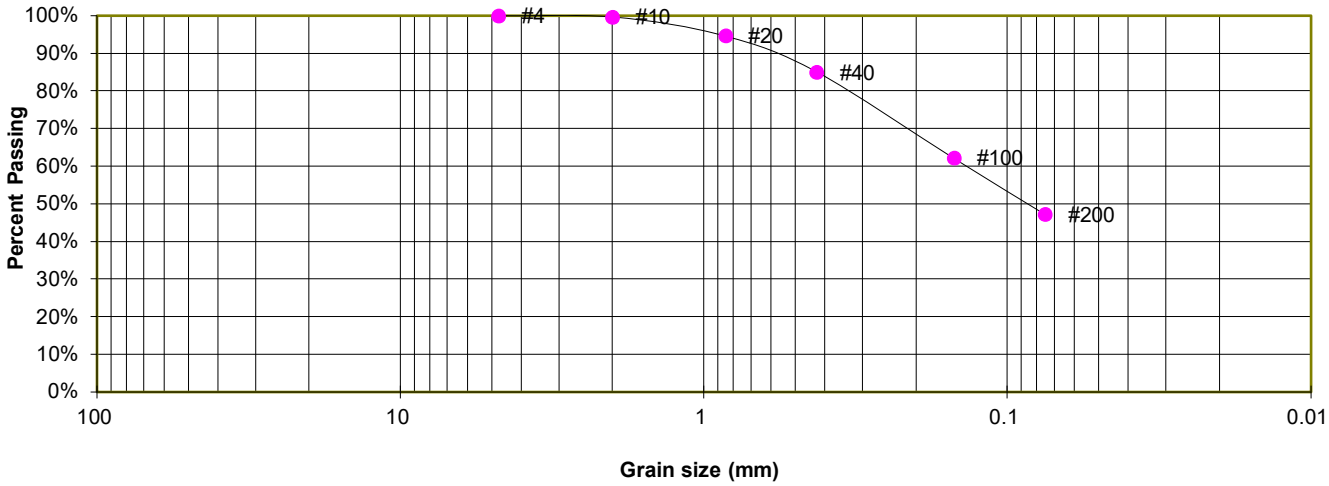
FIG. B-13

TEST BORING	1	SOIL DESCRIPTION	SANDSTONE (SAND, SILTY)
DEPTH (FT)	1-2	SOIL TYPE	4



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	
4	100.0%
10	99.7%
20	94.6%
40	85.1%
100	62.1%
200	47.2%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-4
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

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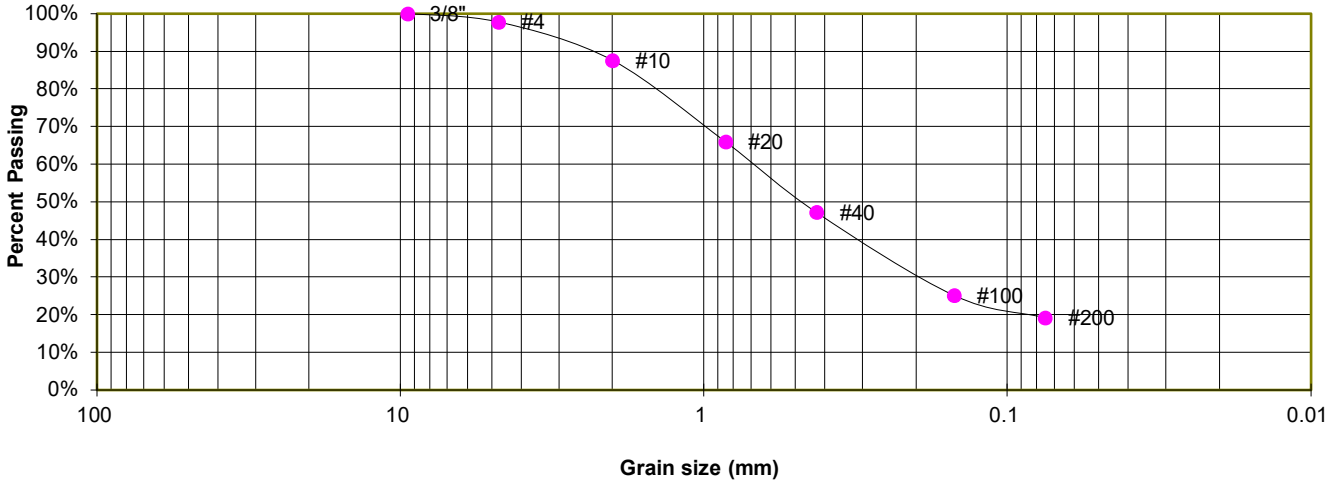
FIG. B-14

TEST BORING	2	SOIL DESCRIPTION	SANDSTONE (SAND, SILTY)
DEPTH (FT)	1-2	SOIL TYPE	4



GRAIN SIZE ANALYSIS

U.S. Sieve #	Percent Finer
3"	
1 1/2"	
3/4"	
1/2"	
3/8"	100.0%
4	97.8%
10	87.6%
20	66.0%
40	47.2%
100	25.2%
200	19.2%

ATTERBERG LIMITS

Plastic Limit	NP
Liquid Limit	NV
Plastic Index	NP

SOIL CLASSIFICATION

USCS CLASSIFICATION:	SM
AASHTO CLASSIFICATION:	A-2-4
AASHTO GROUP INDEX:	0

ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

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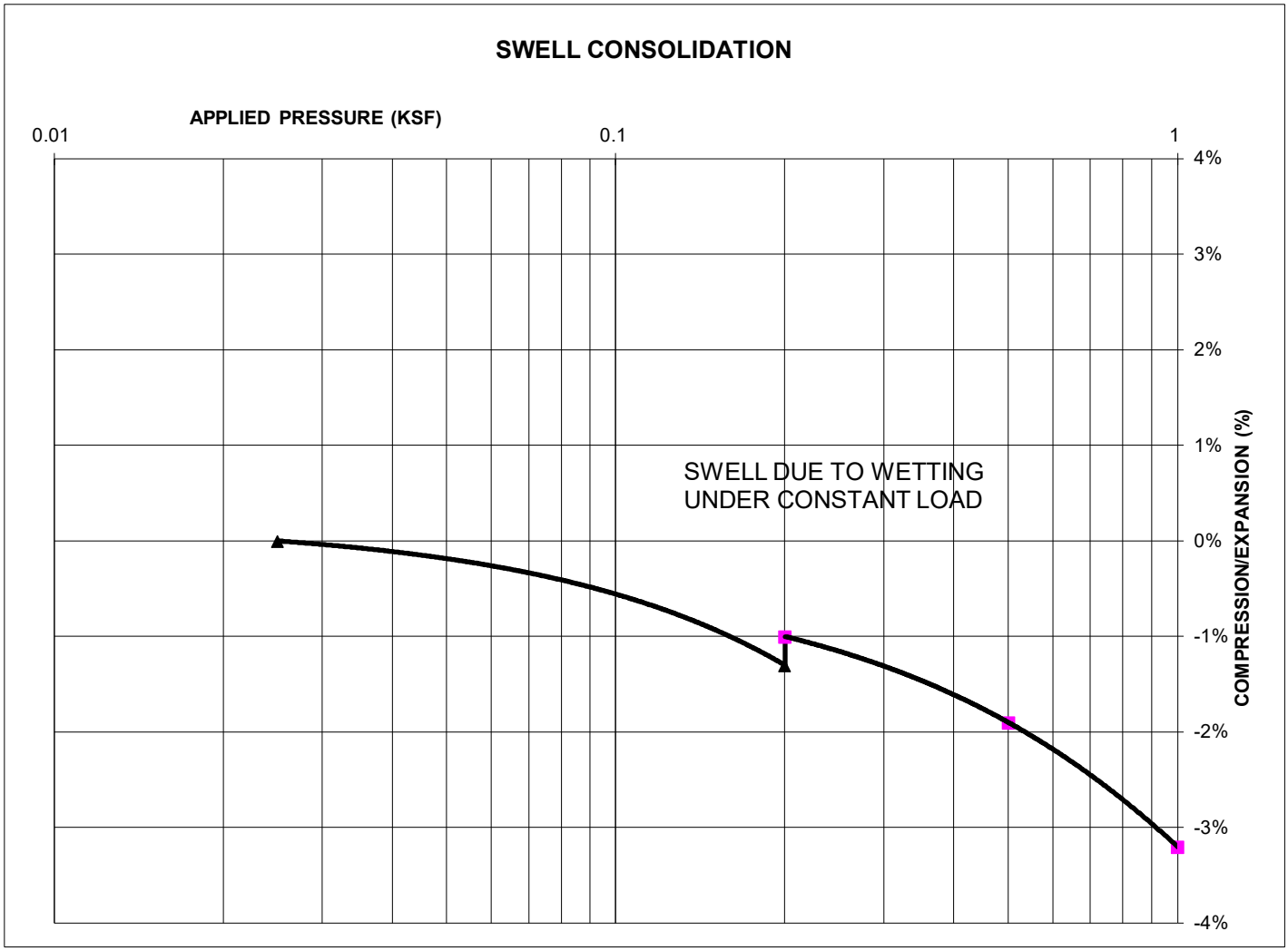
FIG. B-15

TEST BORING	4	SOIL DESCRIPTION	FILL, CLAY, SANDY
DEPTH (FT)	5	SOIL TYPE	2



SWELL/COLLAPSE TEST RESULTS

NATURAL UNIT DRY WEIGHT (PCF): 117
NATURAL MOISTURE CONTENT: 12.0%
SWELL/COLLAPSE (%): 0.3%

ENTECH ENGINEERING, INC.

SWELL TEST RESULTS

RETREAT AT PRAIRIE RIDGE, FILING NO. 2
CLASSIC SRJ

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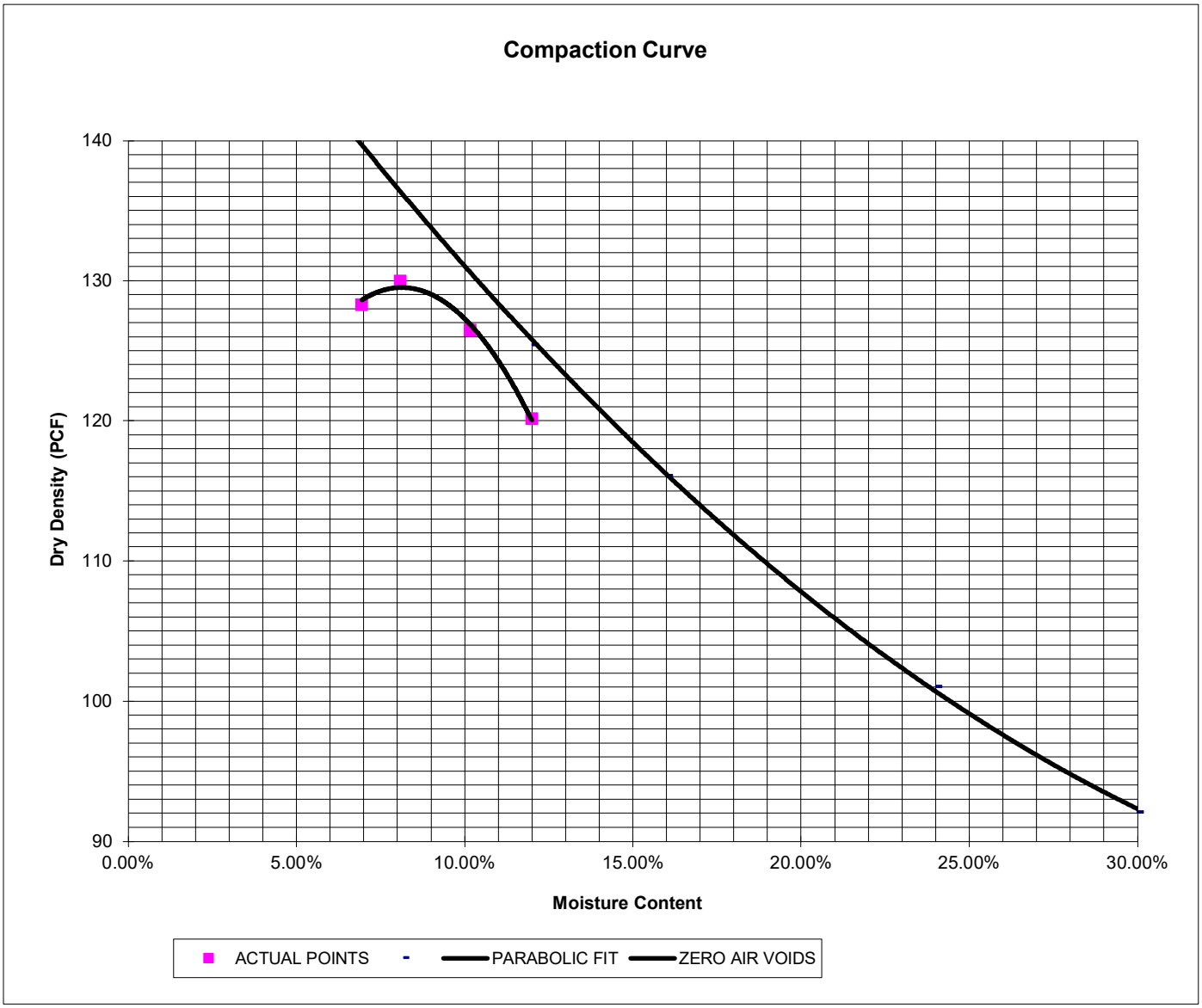
FIG. B-16

SAMPLE LOCATION TB-3 @ 0-3'	SOIL DESCRIPTION FILL, SAND, SILTY, TAN
	SOIL TYPE 1

PROCTOR DATA

IDENTIFICATION:	SM
PROCTOR TEST #:	1
TEST BY:	DK
TEST DESIGNATION:	ASTM-1557-A
MAXIMUM DRY DENSITY (PCF):	129.4
OPTIMUM MOISTURE:	8.1



ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

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FIG. B-17

SAMPLE LOCATION TB-3 @ 0-3' SOIL DESCRIPTION FILL, SAND, SILTY, TAN
SOIL TYPE 1

CBR TEST LOAD DATA

Piston Diameter (cm): 4.958
Piston Area (in^2): 2.993

Penetration Depth (inches)	*10 BLOWS* Mold # 1 Load (lbs)	Stress (psi)	*25 BLOWS* Mold # 2 Load (lbs)	Stress (psi)	*56 BLOWS* Mold # 3 Load (lbs)	Stress (psi)
0.000	0	0.00	0	0.00	0	0.00
0.025	233	77.86	699	233.58	1072	358.23
0.050	286	95.57	971	324.48	1685	563.07
0.075	308	102.92	1131	377.94	2160	721.80
0.100	328	109.61	1323	442.10	2568	858.14
0.125	380	126.98	1509	504.26	2885	964.07
0.150	409	136.67	1629	544.36	3060	1022.55
0.175	439	146.70	1739	581.12	3236	1081.37
0.200	462	154.39	1897	633.92	3513	1173.93
0.300	544	181.79	2390	798.66	4686	1565.91
0.400	660	220.55	2780	928.99	5541	1851.62
0.500	755	252.30	3227	1078.36	6000	2005.01

MOISTURE AND DENSITY DATA

	Mold # 1	Mold # 2	Mold # 3
Can #	506	507	508
Wt. Can	8.33	8.34	8.49
Wt. Can+Wet	276.4	259.58	203.83
Wt. Can+Dry	245.86	233.63	185.86
Wt. H20	30.54	25.95	17.97
Wt. Dry Soil	237.53	225.29	177.37
Moisture Content	12.86%	11.52%	10.13%
Wet Density (PCF)	126.6	135.2	139.6
Dry Density (PCF)	117.1	125.1	129.1
% Compaction	91%	97%	100%
CBR	10.96	44.21	85.81

PROCTOR DATA

Maximum Dry Density (pcf)	129.4
Optimum Moisture	8.1
90% of Max. Dry Density (pcf)	116.5
95% of Max. Dry Density (pcf)	122.9

CBR at 90% of Max. Density = 8.1 ~ R VALUE 22
CBR at 95% of Max. Density = 35.3 ~ R VALUE 74

ENTECH ENGINEERING, INC.

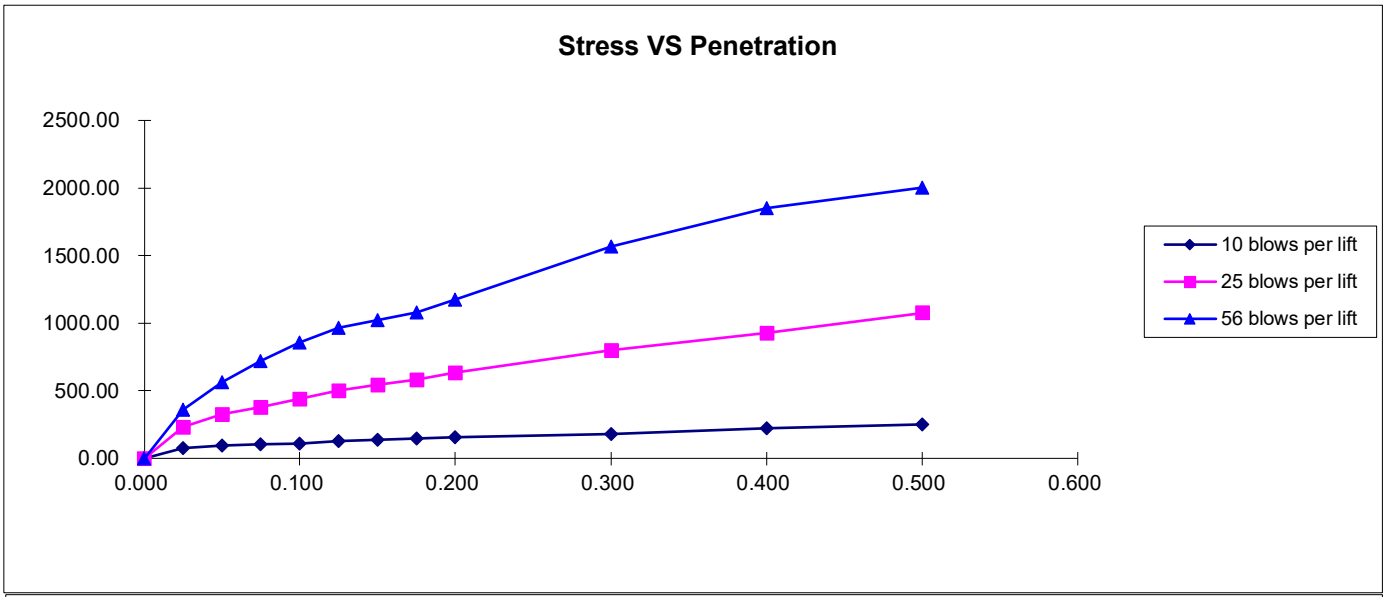
LABORATORY TEST RESULTS

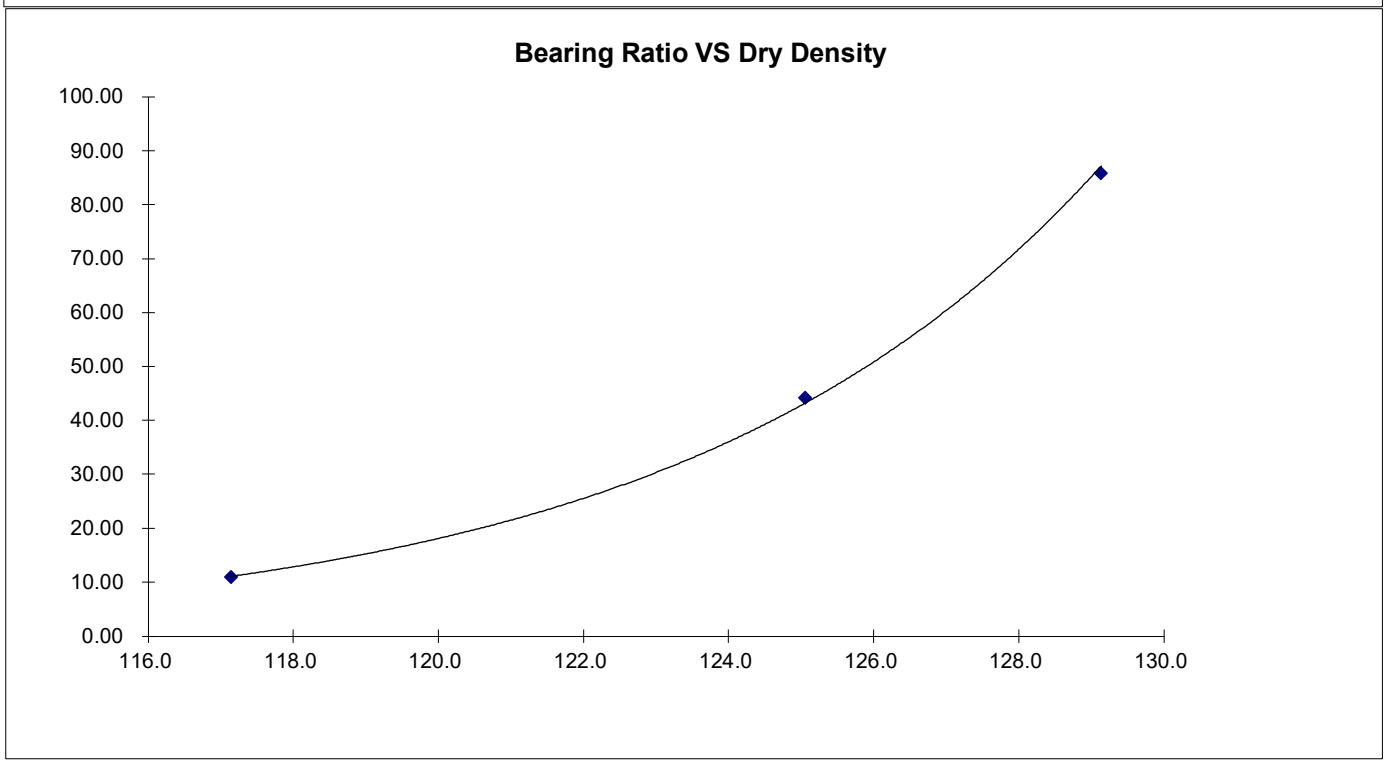
RETREAT AT PRAIRIE RIDGE, FILING NO. 2
CLASSIC SRJ

JOB NO. 241932

FIG. B-18

SAMPLE LOCATION TB-3 @ 0-3'	SOIL DESCRIPTION FILL, SAND, SILTY, TAN SOIL TYPE 1





ENTECH ENGINEERING, INC.

LABORATORY TEST RESULTS

RETREAT AT PRAIRIE RIDGE, FILING NO. 2
CLASSIC SRJ

JOB NO.
241932

FIG. B-19

APPENDIX C: Pavement Design Calculations

FLEXIBLE PAVEMENT DESIGN

PROJECT DATA

Project Location: Retreat at Prairie Ridge, Filing No. 2

Job Number: 241932

DESIGN DATA

Equivalent (18-kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	5,256,000
Design CBR	CBR =	10
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.0
Reliability	Reliability =	90
Reliability (z-statistic)	Z_R =	-1.28
Soil Resilient Modulus	M_R =	15,000 psi

Required Structural Number (SN): → SN = 3.40

DESIGN EQUATIONS

Resilient Modulus

If using CBR:

$M_R = (CBR) \times 1{,}500$

If using R-Value:

$M_R = 10^{[(S_1 + 18.72) / 6.24]}$ where: $S_1 = [(\text{R-value} - 5) / 11.29] + 3$

Required Structural Number

$$\log_{10}W_{18} = Z_R * S_O + 9.36 * \log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2 - 1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32 * \log_{10}M_R - 8.07$$

Pavement Section Thickness

$SN^* = C_1D_1 + C_2D_2$ where:

C_1 = Strength Coefficient - HMA

C_2 = Strength Coefficient - ABC/RCB

D_1 = Depth of HMA (inches)

D_2 = Depth of ABC/RCB (inches)

RECOMMENED THICKNESSES

Layer	Material	Structural Layer	Thickness (D^*_i)	SN^*_i	SN
1	HMA	C_1 = 0.44	5.0 inches	2.200	-
2	ABC/RCB	C_2 = 0.11	12.0 inches	1.320	
			SN* =	3.520	3.40

Pavement SN > Required SN, Design is Acceptable

FIG. C-1

FLEXIBLE PAVEMENT DESIGN

PROJECT DATA

Project Location: Retreat at Prairie Ridge, Filing No. 2

Job Number: 241932

DESIGN DATA

Equivalent (18-kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	5,256,000
Design CBR	CBR =	10
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.0
Reliability	Reliability =	90
Reliability (z-statistic)	Z_R =	-1.28
Soil Resilient Modulus	M_R =	15,000 psi

Required Structural Number (SN): → SN = 3.40

DESIGN EQUATIONS

Resilient Modulus

If using CBR:

$M_R = (CBR) \times 1{,}500$

If using R-Value:

$M_R = 10^{[(S_1 + 18.72) / 6.24]}$ where: $S_1 = [(R\text{-value} - 5) / 11.29] + 3$

Required Structural Number

$$\log_{10}W_{18} = Z_R * S_O + 9.36 * \log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2 - 1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32 * \log_{10}M_R - 8.07$$

Pavement Section Thickness

$SN^* = C_1D_1 + C_2D_2$ where:

C_1 = Strength Coefficient - HMA

C_2 = Strength Coefficient - CTS

D_1 = Depth of HMA (inches)

D_2 = Depth of CTS (inches)

RECOMMENED THICKNESSES

Layer	Material	Structural Layer	Thickness (D^*_i)	SN^*_i	SN
1	HMA	C_1 = 0.44	5.0 inches	2.200	-
2	CTS	C_2 = 0.11	12.0 inches	1.320	
			SN* =	3.520	3.40

Pavement SN > Required SN, Design is Acceptable

FIG. C-2

FLEXIBLE PAVEMENT DESIGN

PROJECT DATA

Project Location: Retreat at Prairie Ridge, Filing No. 2

Job Number: 241932

DESIGN DATA

Equivalent (18-kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	821,000
Design CBR	CBR =	10
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.0
Reliability	Reliability =	85
Reliability (z-statistic)	Z_R =	-1.04
Soil Resilient Modulus	M_R =	15,000 psi

Required Structural Number (SN): → SN = 2.44

DESIGN EQUATIONS

Resilient Modulus

If using CBR:

$M_R = (CBR) \times 1{,}500$

If using R-Value:

$M_R = 10^{[(S_1 + 18.72) / 6.24]}$ where: $S_1 = [(R\text{-value} - 5) / 11.29] + 3$

Required Structural Number

$$\log_{10}W_{18} = Z_R * S_O + 9.36 * \log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2 - 1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32 * \log_{10}M_R - 8.07$$

Pavement Section Thickness

$SN^* = C_1D_1 + C_2D_2$ where:

C_1 = Strength Coefficient - HMA

C_2 = Strength Coefficient - ABC/RCB

D_1 = Depth of HMA (inches)

D_2 = Depth of ABC/RCB (inches)

RECOMMENED THICKNESSES

Layer	Material	Structural Layer	Thickness (D^*_i)	SN^*_i	SN
1	HMA	C_1 = 0.44	4.0 inches	1.760	-
2	ABC/RCB	C_2 = 0.11	8.0 inches	0.880	
			SN* =	2.640	2.44

Pavement SN > Required SN, Design is Acceptable

FIG. C-3

FLEXIBLE PAVEMENT DESIGN

PROJECT DATA

Project Location: Retreat at Prairie Ridge, Filing No. 2

Job Number: 241932

DESIGN DATA

Equivalent (18-kip) Single Axle Load Applications (ESAL):	ESAL (W_{18}) =	821,000
Design CBR	CBR =	10
Standard Deviation	S_o =	0.45
Loss in Serviceability	Δpsi =	2.0
Reliability	Reliability =	85
Reliability (z-statistic)	Z_R =	-1.04
Soil Resilient Modulus	M_R =	15,000 psi

Required Structural Number (SN): → SN = 2.44

DESIGN EQUATIONS

Resilient Modulus

If using CBR: $M_R = (CBR) \times 1{,}500$

If using R-Value: $M_R = 10^{[(S_1 + 18.72) / 6.24]}$ where: $S_1 = [(\text{R-value} - 5) / 11.29] + 3$

Required Structural Number

$$\log_{10}W_{18} = Z_R * S_O + 9.36*\log_{10}(SN+1) - 0.20 + \frac{\log_{10}\left[\frac{\Delta PSI}{4.2 - 1.5}\right]}{0.40 + \frac{1094}{(SN+1)^{5.19}}} + 2.32*\log_{10}M_R - 8.07$$

Pavement Section Thickness

$SN^* = C_1D_1 + C_2D_2$ where:

C_1 = Strength Coefficient - HMA

C_2 = Strength Coefficient - CTS

D_1 = Depth of HMA (inches)

D_2 = Depth of CTS (inches)

RECOMMENED THICKNESSES

Layer	Material	Structural Layer	Thickness (D^*_i)	SN^*_i	SN
1	HMA	C_1 = 0.44	4.0 inches	1.760	-
2	CTS	C_2 = 0.11	8.0 inches	0.880	
			SN* =	2.640	2.44

Pavement SN > Required SN, Design is Acceptable

FIG. C-4